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THE REPLANTING AND REJUVENATION OF OLD RUBBER AREAS

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A DISEASE OF YOUNG BUD-SHOOTS CAUSED BY *PHYTOPHTHORA PALMIVORA*, BUTLER

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PRICKING TESTS ON SOME YOUNG BUD-GRAFTS IN THE RUBBER RESEARCH SCHEME EXPERIMENT STATION BUD-WOOD NURSERY

NUMBERING OF VOLUMES.

The Quarterly Circular of the Rubber Research Scheme (Ceylon) has been issued regularly since 1924, but up to the present it has not been divided into volumes. It is proposed to regard the issues for each year as one volume, and in future to number the pages consecutively, for each volume.

The present issue constitutes Vol. 7, Part 1.

THE REPLANTING AND REJUVENATION OF OLD RUBBER AREAS

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The outlook in brief.—The low market prices for crude rubber prevailing recently have shown unmistakeably to all that a number of our present estates will, in all probability, within the next decade be unable to compete with the younger properties which have been planted up with selected high-yielding material. The coming into bearing of these modern plantations will render available quantities of rubber at a price which will encourage its use in many ways at present scarcely contemplated or, at most, only experimented with. Road-making may be a case in point. It is improbable that the price of the raw material will be stabilized at any very low figure but, it seems safe to say that the opening up of high-yielding areas will very considerably reduce the average price of the commodity. Large dividends may continue to be paid, but they will be the perquisite of high-yielding estates with the resultant low cost of production. Should such a situation eventuate, our poorer estates will be faced with the choice of replanting or abandoning.

The intention of the writer is not to suggest that every estate should start replanting now but to point out some ways in which preparations can be made against the time when such action may become necessary, and naturally these remarks are intended principally for low-yielding properties with no jungle reserve.

The need for carefully thought-out experiment.—Judging from enquiries received and by the number of estates which are starting to replant small areas, the question is receiving due consideration in certain quarters. A number of so-called experiments on replanting are being started now but unfortunately with little thought to the economics of the operation. Only in a few instances, for example, has any attempt been made to realise any of the capital invested in the old trees. In the writer's opinion, the cutting out of these trees without first "bleeding them white" amounts to a breach of trust. Their

removal and replacement by high-yielding strains presents no real difficulty, and this part of the operation resembles to a large extent the opening of a new clearing. Where experiment is really required is in the method of overtapping to be adopted so that the maximum yield can be obtained from the old trees before removal. The actual costs of the operation as a whole cannot be properly estimated unless this is known. Any future programme drawn up will be based on the experience gained and the expenses incurred during these trials.

Further, most of the estates which are starting their experiments have no proved bud-wood growing on their properties. One or two years' heavy tapping before removal would allow time for the multiplication of the bud-wood required and the budding of the young plants to be put out, thus effecting a considerable saving on original outlay on planting material.

Replanting or rejuvenation.—Some distinction should be drawn between these two terms. The complete removal of all trees and subsequent replacement should be termed replanting, whereas rejuvenation of an area can be taken to mean the removal and replacement of all poor or medium trees, and the retention of the best.

Rejuvenation may prove preferable in certain cases but it is considered inadvisable to leave more than 10 per cent. of the previous stand and no tree yielding less than 10 lb. of dry rubber per annum. The retention of a larger percentage introduces competition between the old and young trees for light and ground space and may well lead to disappointment.

The present note is written on the assumption that replanting is the better method for the areas likely to be treated in the near future, and no trees other than exceptional yielders or mother-trees will be left.

Overtapping prior to removal of old trees.—On most estates there is sufficient bark of tappable thickness to permit of the tapping of a cut on both sides of the trees (on alternate days) for a period of at least two if not three years. This tapping of both cuts to the normal depth will produce at least one and a half times as much latex as the tapping of one cut. Thus in three years a yield equal to that normally obtained in four and a half years is obtained. If, during this tapping, the bottom nine inches or so of the trunk is avoided, there will remain bark sufficient for one year's heavy tapping on the highest-yielding portion of the tree. Thus the fourth year, that is the year before removal of the trees, should yield a much increased crop, and, if thick shavings are taken and subsidiary cuts put in, wherever there is bark within

reach, the yield of the fourth year can be expected to be equal to two and a half times the previous yield of the area. In four years, therefore, extra crop equivalent to the return from three normal years' tapping can be obtained, the extra revenue from which will considerably reduce the cost of the operation or, alternatively, go a certain way to compensate for loss of crop during the period when the young rubber is reaching maturity.

It is not suggested that the above scheme will prove the best but it would appear to be a suitable starting point for experiment. It may be necessary in some cases to reduce the period of overtapping to a total of three or even two years.

Table 1 gives the tapping arrangements and table 2 the expectation of crop over the period of overtapping. In these tables it is assumed that an area is being replanted on a ten-year basis, one-tenth of the area being cleared each year. The unit of yield represents the yield which would be obtained from that area under normal tapping conditions.

Table 1.

Plots ...	1	2	3	4	5	6	7	8	9	10
1930 ...	x	n	n	n	n	n	n	n	n	n
1931 ...	x	x	n	n	n	n	n	n	n	n
1932 ...	x	x	x	n	n	n	n	n	n	n
1933 ...	=	x	x	x	n	n	n	n	n	n
1934 ...	0	=	x	x	x	n	n	n	n	n
1935 ...		0	=	x	x	x	n	n	n	n
1936 ...			0	=	x	x	x	n	n	n
1937 ...				0	=	x	x	x	n	n
1938 ...					0	=	x	x	x	n
1939 ...						0	=	x	x	x
1940 ...							0	=	x	x
1941 ...								0	=	x
1942 ...									0	=
1943 ...										0

n = tapped normally.
x = tapped both sides to normal depth.
= = final tapping.
0 = trees cut out.

Table 2.

Plots ...	1	2	3	4	5	6	7	8	9	10
1930 ...	1·5	1	1	1	1	1	1	1	1	1
1931 ...	1·5	1·5	1	1	1	1	1	1	1	1
1932 ...	1·5	1·5	1·5	1	1	1	1	1	1	1
1933 ...	2·5	1·5	1·5	1·5	1	1	1	1	1	1
1934 ...		2·5	1·5	1·5	1·5	1	1	1	1	1
1935 ...			2·5	1·5	1·5	1·5	1	1	1	1
1936 ...				2·5	1·5	1·5	1·5	1	1	1
1937 ...					2·5	1·5	1·5	1·5	1·5	1
1938 ...						2·5	1·5	1·5	1·5	1
1939 ...							2·5	1·5	1·5	1·5
1940 ...								2·5	1·5	1·5
1941 ...									2·5	1·5
1942 ...										2·5

The removal of the trees.—This should be thorough, but, in the opinion of the writer, not more than Rs. 200 per acre need be spent on this item unless it is known that root disease is prevalent. Mention has been made of Rs. 450 per acre as being the minimum cost of efficient clearing but it seems inconceivable that the risk of *Fomes* infection warrants the expenditure of the extra Rs. 250 or, alternatively, it is scarcely within the bounds of possibility that necessary control measures, should *Fomes* break out, will cost an *average* of Rs. 250 an acre. Several blocks have been efficiently cleared at a cost much lower than Rs. 200 per acre.

The actual method of removal will vary with conditions and it may be carried out by the agency of elephants or monkey grubbers or by hand according to which is most convenient or least expensive. The time of removal should be just after the new year's leaf has been put on. This provides a double crop of leaf for soil enrichment purposes. This point will be mentioned again later.

Disposal of the timber.—This again will depend on conditions and situation. Where the block is adjacent to a road or canal the timber might sell on the ground at Re. 1·00 per yard before being cut up, and at least that figure should be obtainable for firewood already cut. In some instances it may be possible to obtain the services of a contractor who will remove the trees and side roots in exchange for the firewood obtained. If there is no market for firewood the timber may have to be burned on the land. In such cases burning should be localised so that the

soil is depleted of the remaining humus to as small an extent as possible. If holes or contour trenches have been cut before felling, the logs should be burned over these so that all ash is caught.

It has been suggested elsewhere (The problem of survival —replanting and supplying considerations, by G. F. S. Sutton, *India-Rubber Journal*, Oct. 12, 1929) that the timber be converted into charcoal and stored in that form for future use in suction gas engines. It is there stated that, where extensive replanting is being done, it would even pay to scrap existing power installations and put in gas engines, as this fuel is four and a half times as cheap as crude oil. From another source the suggestion emanates that the charcoal might be made into dust and the dust made into briquettes with low grade tapioca flour, in which state it will keep much longer. Such considerations are not in the sphere of the present writer but are included so that this note may be reasonably complete.

Reopening of the land.—Except on the flattest of land it is considered that some form or other of contour planting should be adopted. Also as much of the holing, trenching or silt-pitting as possible should be done before the removal of the old trees. The holes, etc. can then be at least partially filled with the leaf from the trees. None of this leaf should be burned; it is valuable for the reconditioning of the soil. Two years' leaf will be available if felling is carried out just after refoliation, and a handful of cyanamide in each hole along with the green matter will help to form a useful compost.

Where funds permit, the adoption of the Denham Till method of contour trenches is recommended. As this method of opening has been fully dealt with already in *The Tropical Agriculturist* there is little object in going into details. Considerable lengths of these trenches can be cut before the old trees are removed and they provide convenient places for the burying of any green material available.

If trenching is not to be carried out contour terracing may be possible and in this case as many as possible of the large planting holes, at least 3 ft. cube, should be cut before the felling. These will naturally follow the contours of the hill and so permit later of the cutting of the terraces, if this has not also been possible to a certain extent before clearing.

Even if neither system is possible, planting should be done on the contour so as to permit of the subsequent planting of contour hedges of some leguminous plant to stop wash. The opening of silt-pits or the building of stone terraces is also facilitated by such a procedure. In certain cases it may be possible to convert the existing drains to the lock and step or similar system.

Reconditioning of the soil, cover crops, etc.—The establishment of cover crops should be one of the first considerations. Seed should be put in just after the trees are removed, while the soil is still loose. Any Vigna torn up during felling and uprooting should be put in the planting holes.

A mixture of leguminous plants should be used so that a heavy cover is obtained without delay. As cover plants *Dolichos hosei* (Vigna), *Calopogonium mucunoides*, *Centrosema pubescens* and *Centrosema plumieri* can be all used together or a selection made. If, previously, Vigna has grown satisfactorily this may suffice alone. The above, however, are almost entirely ground covers; their chief function is to prevent wash, and the greatest need of our average soil is an increase in the humus content. This is best brought about by growing some of the taller legumes, frequently distinguished as green manures. *Tephrosia candida*, the Crotalarias, *Indigofera arrecta*, *Desmodium gyroides*, *Clitoria cajanifolia* can be used. They should be put in as contour belts. There is no reason why, for a year or two, the areas between the contour rows of young rubber should not resemble a dense " cheddy " growth of the taller legumes. Only in this way and by frequent lopping and burying of the loppings will the soil gradually resume its earlier fertility. There is no objection to growing Gliricidias or *Leucana glauca* here as well; besides providing material for burying they serve as protection from wind and as light shade.

Where the contour trenches are employed all the material from the earlier prunings can be accommodated in these as it is usual to fill up, in the first instance, only the parts which are to be occupied by plants. The intervening portions provide excellent places for cheap burying, and the material is exactly where it can be made use by the extending root systems of the young plants. The addition of a little cyanamide, or a cyanamide-phosphate mixture, to the trenches at the same time as the green matter is buried hastens decomposition and renders the material more readily available.

Wind breaks.—It is well before cutting out old rubber to study the direction of the monsoon winds and it may be necessary or advisable to leave belts of the old trees as temporary wind breaks. Such belts can be replaced if desired by Albizzias or Grevilleas but these take some time to grow, and it is in the earlier years that the need of shelter is felt. If Albizzias are not left for more than five or six years there should be little danger of propagation of root disease after their removal. The growing of Albizzias as permament wind breaks is not advised; sooner or later they must be removed and this is a costly operation and attended with considerable danger to the neighbouring rubber trees.

Replanting material.—The use of proved clones of budded rubber is advised where a large area is being replanted. Real selected seed is not condemned, but this is very scarce in Ceylon, and is likely to remain so for some time.

Apart, however, from proved clones bud-wood may be used from local high-yielders, but the use of such material must be considered experimental, and no large area should be planted up from any one tree. Fifty to one hundred plants are sufficient to bud from any such source. The planting up of this quantity is, however, strongly advised, as it is only in this way that new high-yielding clones will be discovered.

It is the opinion of the writer that, whatever the material used for replanting, each clone should be kept separate and not mixed up, even systematically. The reason for this is that, in all probability, different clones will have to be tapped in different ways to give of their best. Clone A may respond well on alternate-day tapping, Clone B probably can only stand third-day tapping. Again, Clone C may respond best when tapped at a height of 5 feet in all probability necessitating the return to use of the old draw knife. It will be impossible to get the best out of all members of a mixed population by a single method of tapping.

As only very small blocks are to be planted up with unproved material, the planting up of a mixture of clones with a view to future thinning out need not, it is thought, be considered.

Bud-wood nurseries.—The laying down of bud-wood nurseries is fully described in a booklet entitled *The budding of rubber* which will be issued at an early date by the Rubber Research Scheme, and this should be consulted. It is strongly advised, however, that every estate, or at least every company, should possess a bud-wood nursery containing material from all the best proved clones available.

Supply nurseries.—The writer's opinion is that all budding is best done in the nursery, with subsequent planting out while the buds are still in the dormant state. Budding can be carried out practically throughout the year in a nursery, so that material is available to take advantage of good planting weather. Full details as to laying down nurseries, etc. are given in the booklet mentioned in the last paragraph.

A tentative programme.—It is assumed that the area to be replanted is yielding 300 lb. per acre and that by replanting a yield of 1000 lb. per acre can be obtained. The programme is spread over ten years and for reasons of simplicity it is assumed that 10 acres are being treated at the rate of one acre a year. This facilitates easy calculation for larger areas.

Should it be found that four years' heavy tapping is too much, calculations similar to those given below can be made to show expectation of crop, etc.

Time-table

The one-acre blocks are labelled ABC.....J.

Year	Tapping both sides	Final tapping	Cut out	Bud-wood nursery	Plant supply nursery	Budding	Plant out
1930	A			Plant			
1931	AB			Bud	For A		
1932	ABC			Bud	,, B		
1933	BCD	A			,, C	For A	
1934	CDE	B	A		,, D	,, B	A
1935	DEF	C	B		,, E	,, C	B
1936	EFG	D	C		,, F	,, D	C
1937	FGH	E	D		,, G	,, E	D
1938	GHI	F	E		,, H	,, F	E
1939	HIJ	G	F		,, I	,, G	F
1940	IJ	H	G		,, J	,, H	G
1941	J	I	H			,, I	H
1942		J	I			,, J	I
1943			J				J

Expectation of crop

Plot	A	B	C	D	E	F	G	H	I	J	Total	
1930	450	300	300	300	300	300	300	300	300	300	3150	
1931	450	450	300	300	300	300	300	300	300	300	3300	
1932	450	450	450	300	300	300	300	300	300	300	3450	
1933	750	450	450	450	300	300	300	300	300	300	3900	
1934		750	450	450	450	300	300	300	300	300	3600	
1935			750	450	450	450	300	300	300	300	3300	
1936				750	450	450	450	300	300	300	3300	
1937					750	450	450	450	300	300	2700	
1938						750	450	450	450	300	2400	
1939							750	450	450	450	2100	
1940								750	450	450	1650	
1941	700								750	450	1900	
1942	850	700								750	2300	
1943	1000	850	700								2550	39300
1944	1000	1000	850	700							3550	
1945	1000	1000	1000	850	700						4550	
1946	1000	1000	1000	1000	850	700					5550	
1947	1000	1000	1000	1000	1000	850	700				6550	
1948	1000	1000	1000	1000	1000	1000	850	700			7550	
1949	1000	1000	1000	1000	1000	1000	1000	850	700		8550	
1950	1000	1000	1000	1000	1000	1000	1000	1000	850	700	9550	
1951	1000	1000	1000	1000	1000	1000	1000	1000	1000	850	9850	
1952	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	10000	105000

Expectation of Crop : Analysis.—The crop obtained from the 10 acres, from the start of the experiment up to the time when the area is again yielding an average of 300 lb. per acre (up to fourteenth year), is 39,300 lb. This is in place of 42,000 lb. which would be expected if nothing had been done. The loss is 2,700 lb. on 10 acres in fourteen years or an average drop of 19·3 lb. per acre per annum. Such a drop might quite easily have been encountered quite apart from replanting considerations, owing to loss of trees from disease, etc.

If taken over the whole period of twenty-three years depicted in the above table, 105,000 lb. have been obtained or an avarage of 156·5 lb. per acre more than would normally have been expected.

Considering the period from the fifteenth to the twenty-third year 65,700 lb. are obtained instead of 27,000 lb., an average increase of 430 lb. per acre per annum.

Note.—Should it be considered that the study of growth on replanted land is more urgent than allowed for in the above scheme there is no reason why the over-tapping should not be arranged to allow of the replanting of the first block after two years. Two years is considered the minimum time in which the average Ceylon estate at the present time could multiply sufficient bud-wood and have ready budded material for the replanting. Alternatively, a small subsidiary block may be so tapped as to be ready for replanting in two years' time. This would afford some information on growth and would not interfere with the main experiment.

A DISEASE OF YOUNG BUD-SHOOTS CAUSED BY *PHYTOPHTHORA PALMIVORA*, BUTLER

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IN the Rubber Research Scheme 3rd Quarterly Circular for 1929 attention was drawn to a new disease of young shoots of bud-grafted *Hevea* caused by a species of *Phytophthora*. The following is a more comprehensive account of this disease and the fungus causing it.

Symptoms and Effects.—The symptoms of the disease are best described from inoculations made on young green shoots of nursery seedlings. In the first series of experiments twelve plants were selected and treated as follows:

3 unwounded, inoculated.
3 wounded, inoculated.
3 unwounded, control.
3 wounded, control.

The inoculum consisted of a vigorous growth of the fungus on Quaker Oats agar medium and was applied inside a cotton wool bandage moistened with sterile water, about 6 inches below the extremity of the shoot. The control plants were treated similarly except that the bandages contained only the sterile medium. The wounds were made by removing the epidermis and outer cortical cells over a small area with a sterilised knife. The conditions could of necessity not be kept strictly sterile, and the bandages were subsequently kept moist for a few days with ordinary water.

After two days the inoculated shoots showed blackish, watery-looking, vertical streaks. Six days after the inoculations had been made these streaks had merged into black sunken areas 1-2 inches in length, on the surface of which sporangiophores and sporangia of *Phytophthora* could be seen with a microscope. The disease had progressed slightly further on the wounded than on the unwounded shoots, but in other respects the symptoms were identical. At this stage there was no sign of wilting of any of the shoots. Subsequently the disease spread up and down the shoots and secondary fungi gained entrance. All the control shoots remained healthy.

Plate I.

Plate II.

The progress of the disease is probably dependent in large measure on the weather conditions. When the inoculation experiments described above were carried out the weather was exceptionally dry, and after 1 month the disease, having killed back the shoots for a distance of about 1 foot from the tip, was checked, and new shoots developed below the affected parts. In subsequent inoculations made in wetter weather the shoots were quickly killed back to the extent of the most recent growth increment, and in some cases the leaves had wilted after 3 or 4 days. In no case has the disease been observed to kill the entire plant, but it must be borne in mind that all inoculations have been made on seedlings about 2 years old, and that if the disease attacks a very young bud-shoot the latter may in a few days be killed back to the stock.

Plate I shows a diseased shoot about 10 days after the inoculation was made. The diseased part of the stem was about 2 inches long and darker in colour than the photograph indicates. Plate II shows a shoot which has been killed back for a distance of about 1 foot from the extremity.

The disease has only been observed as occurring in nature on buddings, the attack originating a short distance below the extremity of the shoot. Inoculations on the tip of young shoots of seedlings have, however, caused infection in every case, so that bud-shoots are presumably also liable to this type of infection.

The Causative Fungus.—Two fungi were isolated from the original specimen of the disease, *Phytophthora* sp. and *Gloeosporium alborubrum*. Inoculations with a pure culture of the *Phytophthora* are described above, and since the fungus was recovered in pure culture from the inoculated shoots in the early stages of the disease and successfully re-inoculated into other shoots, the causation of the disease is established.

Owing to the exceptionally large size of the sporangia the fungus was at first thought to differ specifically from *Phytophthora palmivora* (*P. Faberi*) which is the cause of various well-known diseases of Rubber. Cultures were sent to Mr. Ashby of the Imperial Bureau of Mycology and to Mr. Thomson of the Dept. of Agriculture S.S. and F.M.S., to whom the writer is indebted for identifying the fungus as *P. palmivora* in the rubber group. The sporangia are of the *P. palmivora* type but larger than for any strain previously described.

On Quaker Oats agar the fungus produces an abundant aerial mycelium in 3 days. A spherical spore form, which is not quite so thick-walled as the typical chlamydospore of the species, is produced in abundance, while sporangia are relatively scarce. The dimensions of the sporangia of young cultures (3-5 days old) on Quaker Oats agar are $73{\cdot}2 \times 35{\cdot}7$ microns (mean of 150

measurements) with a range of 32-105 × 20-50 microns. The mean ratio of length to width (L/W) is 2·05. The mean diameter of the circular spore form is 40·26 microns (100 measurements) with a range of 20-56 microns.

When grown in mixed culture with a strain of the rubber group no oospores are formed, whereas when grown with a strain of the cacao group oogonia with amphigynous antheridia are freely produced. The isolation must therefore be referred to *Phytophthora palmivora* and is a strain of the rubber group.

Economic Importance.—The disease has not, up to the present, proved a serious factor in retarding the development of young buddings in Ceylon, and has only been reported from three estates. As is indicated above the progress of the disease is largely dependent on wet weather conditions as would be expected from the zoosporangial method of reproduction of the fungus. The chief danger would appear to lie in an outbreak of the disease in a bud-wood nursery in wet weather. If the bud-shoots were very young they might quickly be killed back to the stock and a supply of valuable material might thereby be lost. It is unlikely that older shoots with several growth increments would be completely killed since inoculations have shown that the fungus does not readily attack or spread to the more mature portions of the shoots. There is the possibility, however that *Diplodia* and other secondary fungi might gain entrance to the diseased shoot and cause a complete die-back.

Occurrence in Other Countries.—The disease is known in East and West Java but is stated to occur only when the atmospheric conditions are wet. The fungus causing the disease is apparently the same strain as that isolated in Ceylon. In Sumatra a severe attack of *Phytophthora Faberi* (=*P.palmivora*) in bud-wood nurseries is reported by d' Angremond (1), but it is not known whether this disease was caused by the same strain. In Malaya Weir (2) describes a disease which attacks the young bud-shoot at its extremity and mentions a *Phytophthora* as a possible causal agent.

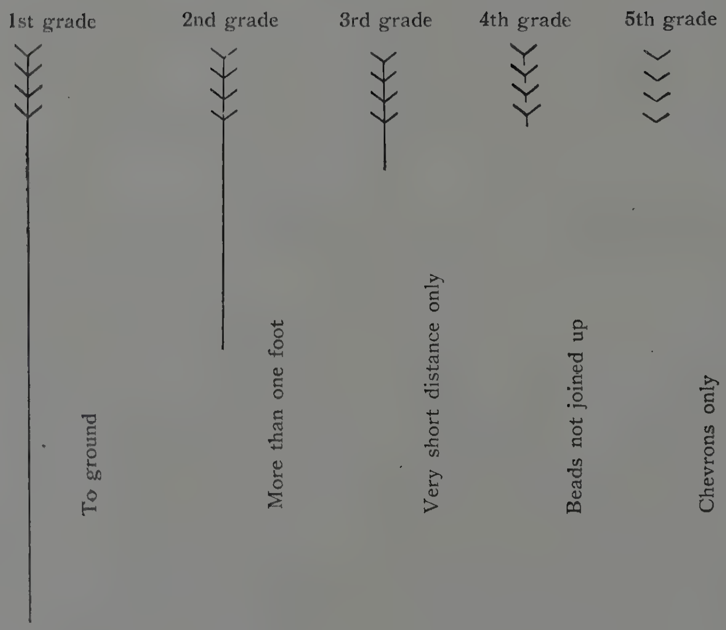
Control.—A careful watch should be kept on young bud-shoots of valuable material during wet weather. Any diseased shoot should be cut off well below the affected parts and burnt. Neighbouring healthy shoots should be periodically sprayed with Bordeaux Mixture.

REFERENCES

(1) D'Angremond, A.—Annual Report of the Director of the General Experiment Station of the A.V.R.O.S. 1st July, 1928-30th June, 1929.

(2) Weir, J. R.—A blight of young buddings. *Quarterly Journal*, Rubber Research Institue of Malaya, Vol. 1, Nos. 1 and 2, 1929.

Fig. 1


1st grade
2nd grade
3rd grade
4th grade
5th grade
To ground
More than one foot
Very short distance only
Beads not joined up
Chevrons only

PRICKING TESTS ON SOME YOUNG BUD-GRAFTS IN THE RUBBER RESEARCH SCHEME EXPERIMENT STATION BUD-WOOD NURSERY

THESE tests were carried out on budded plants varying in age from ten to twenty months. It was the intention to use for this test five plants from each clone and this was adhered to wherever this number was available. In certain cases fewer were used and the order of merit given has been worked out from the average of each clone.

As will be apparent from the results obtained from the three different methods such a test can never give more than a rough indication of the capabilities of a clone, but, on the other hand, it will be observed that in all cases certain clones compete for the leading places in the order of merit.

It may be advisable to emphasise here that it would be unwise to select material for planting schemes on the results of this test. While some indication of prospective yield may be obtained no information is afforded on the behaviour of the trees under tapping conditions. Renewal may be poor, bark may be thin in the first place, the clone may be liable to brown bast, etc.

The methods employed.—(1) This was carried out by the method advocated by Dr. Cramer for seedling selection. His special pricking knife and his system of grading were employed.

The knife makes four identical V-cuts simultaneously on the stem. The cuts are about $1\frac{1}{4}$ inches apart and in the present case were made at a uniform height of three feet above the junction of stock and scion.

In grade 1—the latex from the cuts trickled down to the ground.

In grade 2—the latex trickled down more than a foot below the bottom cut.

In grade 3—the latex from the individual cuts joined up but did not flow any distance.

In grade 4—the bead of latex from each cut did not flow far enough to unite with that from the next cut below.

In grade 5—four chevrons of latex only appeared on the stem.

The results from the different members of the same clone varied to a certain extent among themselves and certain trees were of grade 1 while others were of grade 2, etc. The order of merit has been worked out from the averages.

(2) The same instrument was used but in each case the length of flow of the latex was measured in inches. Order of merit was again worked out from the averages.

(3) By this method a piece of bark was removed with a cork-borer and the latex caught in a plasticine cup stuck on the stem. The small pieces of rubber taken from these cups the following day were weighed to 1/100th of a gram. The order of merit was obtained from the averages.

The clue to the letters is as follows :

W.	Wagga Estate	St. G.	St. George Estate
Kob.	Kobowella Estate	Hun.	Hunasgeriya Estate
H.	Heneratgoda	G.	Govinna Estate
Mad.	Madola Estate	Elad.	Eladuwa Estate
D.K.	Dalkeith Estate	K.G.	Kudaganga Estate
Mal.	Malaboda Estate	Amb.	Ambatenne Estate
Mir.	Mirishena Estate	D.B.K.	Culloden (Diyaberia-kande Divn.)
Yog.	Yogama Estate	P.B.	Prang Besar Estate (Imported)
Tal.	Tallagalla Estate	C.O.D.	Culloden (Old Divn.)
C.	Cuilcagh Estate	Kos.	Kosgalla Estate
B.S.	Beau Séjour Estate	L.	Lawrencewatte Estate
Dorset.	Dorset Estate		

Table I

Order of merit		
1st method	2nd method	3rd method
W. 6278	Kob. 41	Kob. 41
Kob. 41	H. 24	Mir. 11
H. 75	Mal. 1	H. 24
H. 445	H. 85	Mal. 1
H. 249	H 82	H 82
H 401	Tal. 2	D.K. 5315
H. 140	H. 441	H. 86
Mad. 22	H. 464	H. 140
H. 86	D.K. 1	H. 445
H. 441	D.K. 5315	H. 441
H. 362	H. 440	H. 75
D.K. 5315	H. 86	D.B.K. 1
H. 82	Elad. 4	Tal. 2
H. 24	H. 75	H. 362

Table I—*(Contd.)*

Order of merit		
1st method	2nd method	3rd method
D.K. 19935	Mir. 11	Mir. 2
Mal. 1	D.B.K. 1	H. 464
Mad. 15	P.B. 25	H. 401
Mir. 11	W. 6278	W. 6278
Yog. 1 H.	H. 362	Yog. 1 H.
Mad. 18	H. 140	Mad. 18
Mad. 46	Mad. 43	H. 249
Tal. 2	Hun. 1391	G. 771
H. 471	H. 445	C.O.D. 5
C. 3	P.B. 8	C. 3
Mir. 2	Mad. 18	P.B. 25
B.S. 5	H. 401	H. 203
Dorset 1	C. 3	H. 440
H. 355	D.K. 19935	H. 85
H. 464	H. 203	Mad. 46
St. G. 45	St. G. 45	H. 355
Hun. 1391	H. 355	Mad. 15
H. 203	G. 771	D.K. 1
Yog. 8 Y.	Tal. 4	D.K. 3513
Mad. 43	K.G. 5	Dorset 1
G. 771	D.K. 3513	B.S. 5
D.K. 1	Dorset 1	H. 471
D.K. 3513	H. 471	L. 1/15
Elad. 4	H. 249	D.K. 19935
H. 440	D.B.K. 2	Elad. 4
H. 85	P.B. 31	Yog. 8 Y.
K.G. 5	Mad. 46	St. G. 45
Amb. 1	C.O.D. 5	Hun. 1391
D.B.K. 1	Mir. 2	Mad. 43
P.B. 31	Yog. 8 Y.	Amb. 2
P.B. 25	Kos. 6	Kos. 6
C.O.D. 3	B.S. 5	K.G. 5
Tal. 4.	Amb. 1	Amb. 1
Kos. 6	Yog. 1 H.	P.B. 31
Amb. 2	Mad. 15	C.O.D. 4
L. 1/15	Mad. 22	Tal. 4
D.B.K. 2	Amb. 2	D.B.K. 2
P.B. 8	C.O.D. 4	P.B. 8
C.O.D. 5	L. 1/15	C.O.D. 3
C.O.D. 4	C.O.D. 3	Mad. 22

R. A. TAYLOR.
PHYSIOLOGICAL BOTANIST,
RUBBER RESEARCH SCHEME (CEYLON)

DUST-SPRAYING MACHINES

With reference to minute No. 3 of Minutes of Meeting of the Executive Committee held on March 14th, 1930, subscribers of the Rubber Research Scheme are advised that Mr. R. K. S. Murray, Mycologist, Rubber Research Scheme, who has carried out sulphur dusting experiments on Kandanuwara Estate against *Oidium* leaf disease with a Björklund (Dutch) dusting machine, will at an early date test an English Dusting machine and report on the comparative suitability of the machines.

It is suggested that estates which contemplate undertaking sulphur dusting, should await the completion of this test before deciding what type of machine should be given the preference.

NOTICES.

SUBSCRIPTIONS.

Arrangements have now been made for Bulletins and Circulars of the Ceylon Rubber Research Scheme to be made available to non-contributors to the Scheme at the rate of Rs. 15-00 per annum, post free.

GLASS HYDROMETERS.

Glass hydrometers for testing latex and for testing formic acid as specified and as recommended by the Rubber Research Scheme (Ceylon) may be obtained at a cost of Rs. 12·50 and Rs. 10·50 each respectively, from :—

Messrs. WALKER, SONS & Co., Ltd.,
Engineering & Estate Supplies Department,
Colombo.